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ABSTRACT

In this study, eight groups of kindergarten children were trained to discriminate position and order differences in verbal and nonverbal item sequences in the context of a matching task or an associative learning task or both. Transfer was measured by having the subjects sight learn a list of words contrasting in position and order. Subsequently, new function and content words were learned in a sentence format, and all previously learned words were given additional practice in sentences. There was little indication that item-sequence training improved sight-word learning. Grammatical context failed to assist function word learning and showed some impairment of content word learning. While additional sentence practice showed significant improvement in word learning, substantial word recall errors following practice suggested that sentence practice was an efficient way to learn words. It was suggested that subsequent studies consider whether acoustic recognition accompanying the letter differences would improve word learning and that the list format be used for learning sight words prior to sentence reading. (Author/JM)

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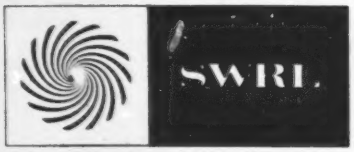

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THE EFFECTS OF LETTER PATTERN TRAINING AND GRAMMATICAL CONTEXT ON SIGHT WORD LEARNING IN KINDERGARTENERS

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ABSTRACT

Eight groups of kindergarten subjects were trained to discriminate position and order differences in verbal and nonverbal item sequences in the context of a matching task or an associative learning task or both. Transfer was measured by having the subjects sight learn a list of words contrasting in position and order. Subsequently, new function and content words were learned in a sentence format and all previously learned words were given additional practice in sentences.

There was little indication that item sequence training improved sight word learning. Grammatical context failed to assist function word learning and showed some impairment of content word learning. While additional sentence practice showed significant improvement in word learning, substantial word recall errors following practice suggested that sentence practice was an inefficient way to learn words.

In consequence of these results, it was suggested that subsequent studies consider whether acoustic recognition accompanying the letter differences would improve word learning and that the list format be used for learning sight words prior to sentence reading.

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THE EFFECTS OF LETTER PATTERN TRAINING AND GRAMMATICAL CONTEXT ON SIGHT WORD LEARNING IN KINDERGARTENERS

Most current reading instruction begins with the reader learning to identify words on a whole or sight word basis. At some later point in the instructional sequence, the possibility of decoding words with the use of letter-sound correspondences (i.e., the phonics attack) is introduced to the child and sight word learning thereafter applied only to a residual small percentage of irregularly spelled words. Where the phonics instruction is to begin in the reading program usually depends on the program designer's view of the beginning reader's readiness to benefit from such instruction.

While the reading acquisition task would be considerably easier with a single identification strategy for all words, the uniform approach may be neither feasible or pedagogically sound. A phonics-based reading program has little alternative but to teach the beginning reader some words by the sight method. Many words essential to sentence construction, such as the function words, either are irregularly spelled and therefore cannot be reached with the more productive letter-sound correspondences, or contain correspondences which are too complex for early reading instruction (e.g., the <u>th</u> pronunciations). It would also be unsatisfactory to have readers learn all words by the sight method. Much of the current emphasis on phonics instruction is based on research showing that children trained on letter-sound correspondences can identify and learn a list of words containing the correspondences significantly better than children

sight trained on other words containing these correspondences prior to acquisition of the word list (Jeffrey & Samuels, 1967).

There may also be motivational grounds for using the sight method in early reading instruction. Prereaders apparently show little ability to retrieve and make use of phonics elements in tasks requiring discriminiation, recognition, and production of individual word sounds (Calfee et al., 1970), and it appears that these skills cannot be developed without considerable training (Marsh & Mineo, 1971). To delay reading experience until the child has mastered some basic phonics skills would only serve to reduce the young child's interest in learning to read. Furthermore, since many children are able to recognize some words by sight prior to formal reading instruction, the sight learning method would be consonant with a word identification strategy that will be either possessed or easily acquired by beginning readers.

However, in having beginning readers view words initially as whole units and later as an ordered set of letter-sound relations, factors are introduced into the reading acquisition process that can impede its progress. In learning words by sight the reader is privileged to limit his selection of cues for recognition to those that minimally differentiate among words learned together. For example, if he is learning 4 new words that vary distinctively on the first letter, he can select this letter as the cue for recognizing each word. Numerous findings from paired-associate learning, which may be considered as the experimental anolog of the sight word method, show that subjects have a tendency to associate the response with only part of the stimulus item (i.e., the functional stimulus).

Studies on word recognition (Marchbanks & Levin, 1965; Williams et al., 1970) and learning (Samuels & Jeffrey, 1966; McCutcheon & McDowell, 1969; Otto & Pizillo, 1970) also show that children at the kindergarten and first grade levels exhibit similar cue selection tendencies.

It should be apparent that the presence of cue selection tendencies can only have an adverse affect on reading acquisition. As more words are given to the reader to sight learn, identification confusion with previously learned words should increase since the selection cues will fail to distinguish members of an enlarged sight word set. This means the reader will then have to attend to more features of words in order to identify the words correctly, which implies interference from the earlier cue selection strategies will likely retard the acquisition of better word scanning strategies.

There is the additional problem that as the phonics decoding strategy takes hold, the sight words which are poorly integrated on the stimulus side will become vunerable to intrusions from subword responses learned in the phonics instruction. More specifically, if the cue used to identify a sight word is a single letter, the remaining letters of word may receive intrusions from phonics decoding responses because of the spelling similarity with phonics-based words. This suggests that where the entire letter sequence of the sight word serves as the cue (or cues) for recognizing the word, intrusions from phonics materials should be more effectively blocked.

The disrupting influence of cue selection in reading acquisition rests in some degree on current procedures used in reading instruction. Usually separate instruction is given on word materials just prior to reading prose containing these materials and words learned at some earlier point in the instructional sequence. Most often practice on the word materials will not be carried to complete acquisition before reading practice begins so that word learning continues during reading. As a result of combining partially learned materials with earlier learned contents in a gammatically constrained context, many cues are introduced which were not present during the initial practice on the word materials. This degree of stimulus change should weaken responses conditioned to the individual words and thus give rise to interference from competing response tendencies.

Moreover, it cannot be contended that practicing words in a reading context will be as efficient as list practice in developing appropriate word scanning strategies. Data on the frequency and type of reading errors commited by first graders (Biemiller, 1970) indicate that readers tend to use context more than graphic information in trying to identify words in the initial stages of reading practice. However, it will be proposed later that a reading context may be useful in learning and recalling words that derive their major meaning and acoustic features from the syntax environment.

It would seem that the difficulties discussed above might be lessened if children were trained to properly attend to the orthographic cues of words as part of the initial instruction on sight word materials. One purpose of the present study is to examine various

training procedures for their effectiveness in getting prereaders to discriminate and remember difference in letter position and letter order in single-syllable words.

Improvement in letter cue attention essentially involves developing the appropriate response sets through practice on tasks that require discriminating orthographic differences. Early reading instruction normally covers some minimally-contrasting words (e.g., the, and them) which ostensiblty could help to develop the child's attention to the relevent letter cues in words. On the other hand, it is doubtful that beginning readers are given much opportunity to contrast similar words since the instruction is usually designed to minimize discrimination difficulties for the novice reader.

Attempts to get children at the early-reader stage to make use of the orthographic differences in learning words have met with some success. Samuels & Jeffery (1966) found that young children will learn to attend to letter differences when trained with the proper contrasting words. Kindergarten and first grade children learned word lists varying in item discriminability, where discriminability was defined as the number of different letters used in constructing four 2-letter words. On the transfer test where the words were combinations of old and new letters, the children receiving the words low in discriminability made fewer identification errors (an "error" was responding with a previously learned word) than the children receiving the easy-to-discriminate words during training. The investigators concluded that initial training on highly similar words will tend to increase attention to letter difference, which can then serve as an

appropriate basis for transfer to learning new words. The words in their study were formed from an artificial alphabet, but essentially the same results have been obtained when real words were used as training stimuli (McCutcheon & McDowell, 1969; Otto & Pizillo, 1970).

Other findings suggest that the effects of discrimination training on subsequent word learning may have limited generality. Giving kindergarteners training on matched but different words (Muehl, 1960) or on the letters contained in the transfer words (Staats et al., 1962) was found to produce little difference from control group performance on the transfer list. Only when children received discrimination pretaining on the transfer words was the performance significantly better than the controls on transfer.

None of the studies on word discrimination in young children had been particularly concerned with the effects of letter position and letter order in words. The results of studies on word recognition indicate that early readers apparently ignore all letters except the word's initial letters in the recognition task (Marchbanks & Levin, 1965; Williams, et al., 1970). It has also been found that children who have had little exposure to printed words tend to disregard letter order information in matching letter sequences in memory (Calfee et al., 1970).

In the present study kindergarten level children are exposed during training to left-right ordered items that vary at specified positions and in sequence. The effects of this training are assessed with a list of contrasting words which are learned by sight.

In designing discrimination training tasks for the present study, consideration was given to the following factors: (1) training task response requirements, (2) familarity with training content, and (3) the phonological and semantic information attending training items.

Learning a list of sight words containing many overlapping letters theoretically should provide the optimal training conditions for transfer to other lists of highly similar words. However, words having many letters in common also tend to be similarly pronounced so that response differentiation becomes an added burden to the learning task. The stimulus learning aspect of word learning can also be studied in the matching task where response similarity should be no problem and response production is within the capability of the learner. It is questionable however, whether this form of practice will transfer to word learning since the response processes of word learning play little role in the performance. Paired-associate learning and the matching procedure are therefore used to train letter pattern discrimination in the present work in order to evaluate the transfer effects of response ease and relevance.

Task content was varied in conjunction with the training task paradigm to determine whether features other than orthographic similarity would influence transfer performance. Under the paired-associate procedure, training materials consisted of either single-syllable words contrasted as the transfer list words or drawings of familiar objects (e.g., clothing) sequenced to parallel

the letter differences in the words. In the matching task, the subject has to make comparisons between nonsense letter strings, sets of familiar objects, or similarly spelled words.

In varying degrees, these training materials were expected to influence how Ss attend to letter sequence differences. While discriminating orthographic differences in the word context is obviously relevant to the transfer task, the phonological and semantic features of the contrasting words may elicit responses that will detract from the discrimination task. Nonsense letter strings that occur infrequently as spelling patterns in words should have less of this problem since a single unitary response cannot easily be associated with a low-meaningful nonsense letter string. On the other hand, low-meaningful materials are less likely to hold the attention of children than will familiar objects, but then the latter may show less transfer to sight word learning than the former because of little similarity to the transfer task. The effects of these training materials on developing discrimination learning sets of the type considered here is largely unknown at this time.

Another purpose of the present study was to determine if a sentence context would facilitate the acquisition and retention of function words. Many sight words introduced in early reading are members of the function word class since function words must be used to form sentences for prose content. Words of this type tend to derive most of their distinctive

sementic and phonological features from association with syntactical structures. In consequence, grammatical context may facilitate learning this class of words since previous work shows that increasing cue saliency tends to improve learning (Ellis & Muller, 1964). Support for this expectation would favor teaching function words in sentence frames rather than as isolated words.

The available finding regarding context aids on learning words belonging to specific word classes however are somewhat inconsistent. Glanzer (1962) reported that response triplets contain function words bounded by two nonsense syllables were learned more easily than similar triplets containing content words. But results from another study (Cofer, 1967) suggested that Glanzer's findings may have been produced by factors other than word class variables. In addition, Simpson (1965) reports that the anticipation errors for words from five grammatical form classes did not differ substantial in rank order over levels of serial approximation to sentence word order or with the other findings where words are learned without context.

There is also the possibility that grammatical context may detract from learning individual words in the same manner that meaning and familarity may inhibit attending to letter differences between words; and some empirical evidence seems to support this notion (Seibert, 1930; Crothers & Suppes, 1967).

The present study was designed to evaluate contextual influences on word learning in two ways. Function and content words were learned in a sentence context and then tested for recall in a list.

If context provides distinctive cues for function words, then function words should be recalled better after sentence learning than content words. The present study also evaluates contextual learning effects by having subjects try to identify the words learned previously in new sentences. This condition should indicate the extent to which word learning generalizes across sentence contexts.

In sum, the present research is designed to study training conditions which should improve attention to letter variation in words and to the cues of a word's characteristic reading context. Some aspects of attention training however were not systematically varied across training conditions. Contrasting materials were sequenced to take advantage of the position preferences manifested in word recognition studies. That is, training began with contrasts located in the initial position of a left-right sequence of items and followed with contrasts in the final and middle positions in that order. In the matching task, subjects were first required to match against alternatives presented concurrently and in later matching problems to perform simultaneous and delayed matches (i.e., standard removed before alternatives are presented to subjects). The delayed matching condition was employed because previous research (Calfee et al., 1970) has suggested that inattentiveness in young children to letter order was due, in part, to a poorly developed set to encode and store order cues.

Method

Design

Each S was trained individually in a series of four tasks. In Task 1, the S was exposed to training procedures expected to develop attention to letter cues in short words. Task 2 tested for Task 1 effects by having all Ss sight learn words contrasting as pairs in letter order and at letter position. Task 3 covered sight learning of function and content words presented either in sentence frames or in a list format. Task 4 involved further training on words from Task 2 and 3 in the context of sentences having many overlapping word cues. Prior to and following Task 4 practice each S received a two-trial recall test of Task 2 and 3 words.

The following training procedures were applied to different groups of Ss in Task 1:

Group I-- sight learn single syllable words

Group II-- match nonsense letter strings under simultaneous and delayed presentation formats

Group III-- learn paired-associates where the stimulus members are sets of objects, drawn in outline, and the response members are varied-colored designs

Group IV-- match sets of line-drawn objects

Group V-- the Group III procedure with easy to discriminate content

Group VI-- the Group IV procedure with easy to discriminate content

Group VII-- sight learn single syllable concrete nouns familiar to kindergarten children

Group VIII-- the Group VII training sequence with matching problems located before and midway through the sequence

The words of the Group I condition varied as pairs in parallel with the word pairs of Task 2. The training materials of Groups III and VII were sequenced to contrast like the Group I words, and Group IV patterns contrasted like the letter strings of Gourp II. Groups V and VI served as controls for nonspecific transfer effects associated with the paired-associate and matching training procedures, respectively. Subjects in these two groups received materials which could be differentiated on the basis of several cues so that item discrimination was easier than that found with the items used in training the other Task 1 groups. Groups VII and VIII were added later to the experiment to study whether attention to letter differences could develop when the contrasting word materials had the semantic features which studies have shown (cf, Dukes & Bastian, 1966) to facilitate word learning, i.e., concrete nouns. It was suggested earlier however, that the semantic features of words may interfere with the development of attention to letter differences. Consequently, in order to promote attention to the letter sequences of the Group VII concrete nouns, the Ss of Group VIII were required to match the nouns to similarily spelled words and nonwords prior to sight learning the nouns.

Eight Ss, four of each sex, were assigned unsystematicaliy to each of the 8 treatment groups of Task 1. After Task 1, the 8 Ss in each treatment group were assigned randomly to the 8 conditions used in Task 3 so that Task 1 conditions were completely balanced, though not replicated, in the Task 3 treatments. Tasks 2 through 4 involved the following 6 treatments: (1) two comparable word sets for constructing

training items of Tasks 2 through 4, (2) function words learned in sentences and content words learned in a list, or vice versa, in Task 3, and (3) the word list learned before the sentences, or vice versa, in Task 3. The sentences in Task 3 were constructed by combining new function or content words with words learned in Task 2. Task 4 sentences were constructed from all the words learned in Tasks 2 and 3. Each word set provided a set of sentences for Tasks 3 and 4. An equal number of function and content[1] words were learned in Tasks 2 and 3. Appendix I lists the items used in paired associate training and an examplar item for each matching problem.

Materials

Each letter, word, sentence, letter sequence, and figure pattern was manually shown to the S on a 5-by-8 file card, with materials centered on the card. The color designs were presented on 2-by-4 file cards and covered the entire card. Figure drawings appeared in outline and varied in size to permit easy recognition. The letters were uniform stroke block capital letters, one-half inch in height.

The words, all single-syllable, were selected from lists compiled from published vocabulary lists and readers appropriate for the early grades. Letter sequences were taken from compiled diagram and trigram lists (Underwood & Schulz, 1960); only sequences having meaningfulness values less than 50 percent were used. The figure drawings represented objects mostly taken from a list used in a study on kindergarten onject identification (Okada & Baker, 1969); the remaining figures represented objects which adults judged kindergarten level children would recognize.

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[1]After the study was completed, it was noted that some function and content words were incorrectly classified.

Procedure

The study was conducted in a two-cubicle mobile lab parked on the school grounds where the Ss were enrolled. Two experimenters ran Ss individually through the training and testing sequence. Each S was trained over a series of days, with training per day limited to 30 minutes. To complete the task series, an average of approximately 9 days was required, with individual Ss ranging from 5 to 14 days.

Training applied to Groups I, III, V and VII in Task 1 was paired-associate in form where the responses were either the acoustic forms of the stimulus (Groups I, and VII) or unrelated to the stimulus (Groups III, and V). Group I learned to identify 10 contrasting words as the words were presented in 7 pairs and in 3, 4 or 10 word lists. Each pair was practiced until 9 in 10 correct identifications of the pair were made. Two or 3 word pairs were brought to criterion and then a list comprising the words in the pairs were learned to a criterion of 3 successive errorless trials. After the last sublist was learned, 10 additional practice trials on the 10 words were given. Group III learned to pair color designs with figure patterns having the same contrasts as the 10 words of Group I. The Group I learning criteria were applied to Group III materials. Group V paired color designs with figure patterns that did not follow the progression of pattern variation of the Group III items. This group also was trained with 12 rather than 10 figure pattern items. The items were presented in 7 pairs and 4 or 12 items lists and learned to the criteria specificed for Group I. Group VII learned concrete single-syllable nouns under the Group I procedure.

Group II training in Task I consisted of matching nonsense letter patterns over a 7-problem series where each problem had 16 different items. Letter pattern discrimination became progressively more difficult over the problem series. Problem criterion was 9 in 10 correct matches. Problems 6 and 7 had two parts: after criterion was reached under simultaneous matching, the problem was recycled and criterion was obtained when the alternatives were presented 2 seconds after the standard was removed from view. Alternatives were presented in a row in front of the S and their order was counterbalanced over items to counteract position biases. Group IV Ss were trained similarly to Group II but with figures substituted for the letters. Group VI followed the schedule used in Groups II and IV but with these exceptions: (1) the Ss were trained on a 5-problem series, (2) discrimination difficulty was not varied over the problem series, (3) problem criterion was raised to 15 out of 15 correct matches, and (4) the delayed matching condition applied only to the last problem (Problem 5).

Group VIII was trained on two matching problems and the Group VII word training procedure. Problem 1 was given before the first word pair and Problem 2 came after criterion was reached on the first sublist. Problem 1 had items which required comparing the first 4 words with similarly spelled words, nonsense words and with each other; Problem 2 required the same kind of comparisons for the last 6 words of the Group VII list. Criterion on each problem was achieved under the simultaneous and delayed matching conditions of Group II.

Task 2 training consisted of learning to identify words presented in 5 pairs and in lists of 4, 6, and 10 words. The conditions of training were the same as Task 1 word learning.

Task 3 involved learning a list of 4 words and a set of 3 sentences. Criterion was 3 successive errorless trials on the sentence and word lists. The sentences contained words learned in Task 2, and either 4 function or 4 content words not previously learned. After criterion was achieved on the sentence list or the word list, whichever came last, a 3-trial recall test on the new words in the sentences was administered under a no-feedback condition.

Task 4 consisted of learning a set of 5 sentences and a 2-trial recall test of words learned in Tasks 2 and 3. The test was applied immediately before (Pretest) and after (Posttest) practice on the 5-sentence list, and under no-feedback conditions. The sentence list was practiced to a criterion of 3 successive errorless trials. Task 4 was administered 24 hours after the completion of Task 3.

The anticipation method was used wherever paired-associate learning was involved, i.e., word and figure pattern pairs and lists, and sentence lists.

For paired-associate learning, the correct response or feedback was given approximately 8 seconds after the item was displayed. In the matching problems the S was required to respond until the correct alternative was identified. Appropriate instructions preceded each task component. To facilitate learning, Ss were required to point out differences and similarities in exemplar stimulus materials prior to training on subsets of Task 1 materials. To motivate and reward

participation in the study, Ss were given play dollars which were redeemable for small trinkets. The Ss also received dollars for significant improvements in performance.

The Ss were preliminarily selected for the study by testing their reading knowledge of the words on the alternate word set. Any child knowing more than one word was rejected from the study. Twenty-one other children were terminated and replaced with other Ss in the study for failure to achieve criterion within 50 trials on any one list or problem. Subject losses, however, appeared to be unsystematically related to training treatments.

Subjects

The Ss were 64 kindergarteners enrolled in 3 local public schools. The Ss ranged in age from 61 months to 78 months, with a mean of 69.1 months. During participation in the study, the Ss did not receive reading instruction at school.

Results

Trials to criterion in list learning and error frequency over a fixed trial block were the primary dependent measures considered in the data analyses. The Task 1 treatments became a factor in the analyses of Task 4 data after it was established that the list practice order factor of Task 3 could be ignored since Task 4 performance was not significantly affected by it. The analysis of Task 3 performance, however, followed the original 2 x 2 x 2 design, i.e., word set by list practice order by word type sentence learning.

Task 1 Transfer

Table 1 presents the means, standard deviations and ANOVA results on components of Tasks 1 through 4 for the Task 1 groups. These results represent the major effects of Task 1 training inasmuch as no reliable interaction was found between Task 1 treatments and other factors considered in the study. Appendix II gives a complete listing of ANOVA summaries.

Table 1 indicates that the groups receiving only matching problems took less time (in terms of sessions) than the other groups to complete Task 1, $F(7,56) = 9.98$, $p < .01$. However, as the table indicates, Task 1 training time shows little relation with subsequent performance.

It is apparent from the table that Task 1 training had only marginal effects on performance in Tasks 2 and 4. Trials to criterion on the word pairs of Task 2 show that the experimental groups did slightly better than the control groups (V and VI) on this task component, however this difference was neither reliable nor characteristic of subsequent performance. At best, it appears that Group I maintains a consistent superiority to its control, Group V, over all components of Tasks 2 and 4. But little value can be attributed to the Group I performance when it is apparent that Group VI, a control for the matching task, performs similarly to Group I on the last component of Task 2 (the 10-word list) and all components of Task 4. Thus, when considering the patterns of performance of these two groups and the evanescent influence of Task 1 training on Task 2, it would appear that discriminating patterns of sequenced

TABLE 1

MEAN, STANDARD DEVIATIONS, AND ANOVA RESULTS FOR TASK 1 GROUPS[1]

Group	Task 1 Sessions	Task 2 Word Pairs: Trials to Criterion	Task 2 Sublists: Trials to Criterion	Task 2 10-word List: Errors	Task 4 Pre-test: Errors	Task 4 Post-test: Errors	Task 4 Sentences: Errors 1st Sentence Trial	Task 4 Sentences: Trials to Criterion
I	3.69 (.43)	10.30 (4.02)	8.00 (5.30)	20.63 (13.68)	7.25 (3.19)	4.38 (3.14)	3.94 (1.22)	6.00 (1.87)
II	2.94 (.30)	10.20 (2.75)	12.38 (9.45)	27.50 (14.62)	9.44 (3.64)	7.06 (4.38)	4.75 (1.22)	10.88 (4.81)
III	3.69 (.56)	10.85 (4.89)	15.25 (10.70)	24.75 (13.52)	8.38 (2.03)	6.31 (3.37)	5.25 (1.17)	11.12 (8.84)
IV	2.94 (.16)	11.42 (6.05)	14.81 (13.27)	21.25 (12.13)	9.37 (3.31)	7.00 (5.24)	5.25 (1.95)	10.00 (14.18)
V	3.56 (.95)	12.95 (8.92)	13.38 (8.58)	21.62 (7.84)	8.25 (2.54)	6.69 (4.07)	5.56 (.81)	7.38 (2.23)
VI	1.94 (.16)	11.85 (7.39)	12.25 (9.34)	14.88 (6.58)	7.25 (2.84)	4.31 (2.75)	3.69 (1.00)	8.63 (2.50)
VII	3.37 (.48)	11.98 (5.55)	15.50 (10.41)	30.88 (11.62)	11.19 (3.63)	9.63 (3.79)	7.69 (1.66)	12.88 (4.68)
VIII	3.81 (.93)	10.32 (3.34)	8.13 (5.66)	22.12 (17.53)	8.19 (3.96)	5.06 (3.66)	4.94 (1.90)	9.87 (4.81)
F	9.89	.94	2.07	1.02	1.63	2.18	3.23	1.60
df	7/56	7/48	7/48	7/48	7/32	7/32	7/32	7/32
p	<.01	>.10	<.10	>.10	>.10	<.10	<.05	>.10

[1]Each mean is based on scores from 8 subjects. Standard deviations are given in parentheses.

items showed little transfer to a task involving sight learning of contrasting words in the present study.

Table 1 also indicates that the Ss in Group VII, the Group I procedure with concrete nouns, performed consistently below the other Task 1 groups. This performance probably can be largely attributed to an age difference effect. The Ss receiving the Group VII training were approximately 4 months younger than Ss in the other groups. This age difference apparently was a chance effect since Ss in this group and in Group VIII were assigned at random to the training conditions at the same time.

Contextual Word Learning

Task 3 was designed to determine whether sentence context would have any differential effect on word type learning. The results from the final recall test indicate that the answer is negative since no reliable difference in errors on content and function words was found, $F(1,56) = 2.80$, $p > .10$, although fewer content than function word errors were made (6.66 vs. 8.13 respectively).

However, recall test scores were affected by practice list order, $F(1,56) = 5.03$, $p < .05$. More errors accompanied learning function words in sentences just prior to testing than when these words were learned in sentences before the word list in Task 3, whereas no such effect was found to influence content word recall. No reasonable explanation can be given for this finding in light of the usual finding that recall interference usually increases following interpolated task learning.

No other effects were found in analyzing Task 3 recall test scores (cf. Appendix II).

Task 4 performance exhibited some residual effects of the context in which function and content words were acquired in Task 3. It was found that while recall of function words in Task 4 was unaffected by the Task 3 learning context, content words were recalled better when Ss learned content words in a list format rather than a sentence context in Task 3. This interaction was found to be significant on the Pretest, $F(1,32) = 11.78$, $p < .10$, the Posttest, $F(1,32) = 5.66$, $p < .05$, and in the error scores for the first sentence list trial of Task 4, $F(1,32) = 5.60$, $p < .05$.

The effect of sentence practice on word learning in Task 4 was examined by finding the average difference between Pretest and Posttest error scores without regard to the treatment conditions of Tasks 3 and 4. The analysis shows that sentence practice led to a significant drop in word recall errors on the Posttest, $t(63) = 6.6$, $p < .01$. An examination of Postest performance in Table 1, however, indicates that sentence practice to a criterion of 3 errorless trials did not bring Posttest performance to anywhere near errorless recall.

While Task 3 recall test scores failed to show any differential effect on learning function and content words in sentences, the recall of these words may be different when the words appear in new sentences. To test for word type transfer effects the difference between the Pretest error score and the errors on the first two sentence trials of the Task 4 sentence list was found for each word type.[2] The t value calculated on these errors indicated that there was no difference in

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[2]The errors for function and content words in sentences were weighted with the frequency of each word type in the sentence set.

the recognition of function and content words in new sentence, t (63) <.1.

Discussion

The original thesis that sight word acquisition and retention could be improved in a prereader population by giving discrimination training on patterns of sequenced elements varying at position and in order found little support in the present work. Whatever advantages the experimental groups had over the control conditions in the transfer task were found to be either trivial or indistinguishable from factors produced by chance assignment i.e., the lower age of Group VII Ss. The

It cannot be argued however, that the discrimination training conditions failed to improve sight word learning because the subjects did not receive sufficient practice or the training materials were inappropriate. List learning and matching performance were carried to criterion levels that normally denote near-mastery levels of performance. The training materials also embodied contrasts in the form of position and order differences that are characteristic of the letter contrasts found in single-syllable words. Moreover, there can be little question that practice on contrasting words during the discrimination training phase, i.e., the training conditions of Groups I, VII, and VIII, has maximum similarity to the training conditions of the transfer tasks.

On the face of it, the present findings on discrimination training effects would appear to disagree with the results of previous studies (Samuels & Jeffrey, 1966; McCutcheon & McDowell, 1969; Otto & Pizillo, 1970) on word discrimination in kindergarteners and first graders. These studies found that the children show better word recognition following training on a list of highly similar words than on a list of dissimilar words. However, when considering only the treatment groups that are comparable to conditions used in the earlier studies performance on the transfer list of contrasting words tends to be consistent with the word recognition performance of the earlier studies. An examination of Table 1 shows that the average performance of Groups I and VIII in Task 2^3 excels that of the control group, Group V, although only slightly so on the 10-word list. It should be recognized, nonetheless that this comparison may be overdrawn since the control group here did not receive discrimination training with words of low similarity.

The lack of effects from word discrimination training however suggests a different approach to improving attention to word spelling differences. It has been well documented that prereaders have poorly developed phonetic segmentation skills (Calfee et al., 1970; Marsh & Mineo, 1970). This would suggest that changes in letter patterns may not be perceived by young children to be related to the specific forms of variation in the acoustic patterns of words. Thus, training to

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[3]Group VII is not considered in the comparison because of the age confounding problem.

discriminate orghographic difference would take care of only part of the attentional process required for effective sight word learning. It may be necessary therefore to determine how to train beginning readers to relate sound pattern differences to orthographic differences during word discrimination training. This kind of emphasis in early reading instruction would also be in accord with work that shows intermodal integration skills are significantly correlated with success in learning to read (Kahn & Birch, 1968).

The results on grammatical context word learning failed to show that function words derived any special benefit from sentence practice. There was some indication that the grammatical learning context, if anything, may have had an adverse effect on the content words relative to learning these words in a list format. It is possible that the sentence training treatments of the present study were inadequately designed to test the effects of grammatical context on word learning. Because the sentences had to be constructed with words that the subjects had previously learned and with new words belonging to only one word type, the sentences tended to have syntax forms (cf. Appendix I) that were most likely unfamiliar to many children.

Sentence practice however did promote word learning in some degree. It was found that practice on sentences having many similarities led to a significant reduction in recall errors on the posttest. Nonetheless, it is questionable whether this procedure is very efficient in developing a reading vocabulary. The posttest results indicated that recall errors rates were still quite high in spite of the high level of performance required on the sentences before practice was terminated, i.e., a criterion of these consecutive errorless trials.

In sum, the findings of the present study suggest that whole word identification performance hinges on more than careful discrimination of word letter differences. Thus, future studies will consider the role of acoustic factors in word discrimination training since the present work and that of other investigators tend to imply that these factors are relevant to sight word learning. It is also suggested by the findings that learning words in a list prior to sentence practice tends to be a more desirable training procedure than learning the words in sentences since sentence mastery does not produce complete learning of individual words.

APPENDIX I

TRAINING SEQUENCES AND MATERIALS

Task 1--

Group I: Sight learn contrasting words

(The content of pairs and lists are given below).

Pair 1-- BY, MY
Pair 2-- BE, BY
Pair 3-- AM, MY
Sublist 1-- The four words of Pairs 1, 2, and 3
Pair 4-- NET, NOT
Pair 5-- NET, TEN
Sublist 2-- The 3 words of Pairs 4 and 5
Pair 6-- DROP, DRIP
Pair 7-- DROP, DOOR
Sublist 3-- The 3 words of Pairs 6 and 7
10-word list-- The words of all Pairs

Group II: Match letter patterns

(The letter pattern form and an exemplar item, in parentheses, for each problem are listed below).

Problem 1-- Single letters (M: M, U, P)
Problem 2-- First letter variation in diagrams (RH: RH, DH, EH)
Problem 3-- Second letter variation in diagrams (RH: RC, RH, RZ)
Problem 4-- Letter reversals in digrams (RH: HR, HD, RH)
Problem 5-- 3- Letter reversals in trigrams (ZTK: ZTK, KTZ)
Problem 6-- Middle letter variation in trigrams (ZTK: ZTK, ZCK, ZBK)
Problem 7-- Left-right and right-left pairwise permutation of letters in trigrams (ZTK: ZTK, ZKT, KZT)

Group III: Paired-associate learn figure patterns

(The color design paired with each pattern is given in parentheses)

Pair 1-- Motorcycle, plane (dark brown); auto, plane (speckled colors)
Pair 2-- Motorcycle, boat (daisies); motorcycle, plane (dark brown)
Pair 3-- Bus, auto (gold-white-black stripes); auto, plane (speckled colors)
Sublist 1-- The 4 items of Pairs 1, 2, and 3
Pair 4-- Man, boy, clown (brown-tan curved lines); man, soldier, clown (yellow-blue horizontal stripes)

Pair 5-- Man, boy, clown (brown-tan curved lines); clown, boy man (green)
Sublist 2-- The 3 items of Pairs 4 and 5
Pair 6-- Elephant, bear, monkey (blue); bear, elephant, monkey (white)
Pair 7-- Elephant, bear, monkey (blue); elephant, monkey, bear (black)
Sublist 3-- The 3 items of Pairs 6 and 7
10 figure-pattern list-- The items of all pairs

Group IV: Match figure patterns

(An exemplar item from each problem is listed below)

Problem 1-- Pineapple: Pineapple; strawberry; cucumber
Problem 2-- Igloo, windmill: Igloo, windmill; house-on-stilts, windmill; teepee, windmill
Problem 3-- Igloo, windmill: Igloo, windmill; igloo, lighthouse; igloo, tent
Problem 4-- Igloo, windmill: Igloo, windmill; windmill, igloo; windmill, house-on-stilts
Problem 5-- Grapes, banana, pear: Grapes, banana, pear; pear, banana, grapes
Problem 6-- Grapes, banana, pear: Grapes, banana, pear; grapes, pineapple, pear; grapes, strawberry, pear
Problem 7-- Grapes, banana, pear: Grapes, banana, pear; grapes, pear, banana; pear, grapes, banana

Group V: Paired-associate learn unsystematic figure patterns

(The color design paired with each pattern in given in parentheses)

Pair 1-- Elephant, bear, monkey (blue); woman, hobby-horse, skates (white)
Pair 2-- Spoon, knife, plate (orange); boat, train, auto (black)
Sublist 1-- The 4 items of Pairs 1 and 2
Pair 3-- Tie, cap (daisies); teepee, windmill (green-blue stripes)
Pair 4-- Igloo, lighthouse (gold-white-black stripes); ruler, saw (colored circles)
Sublist 2-- The 4 items of Pairs 3 and 4
Pair 5-- Star, square, cross (red); lamp, bed, chair (green)
Pair 6-- Man, boy, clown (brown-tan curved lines); deer, tent, giraffe (yellow-blue horizontal stripes)
Sublist 3-- The 4 items of Pairs 5 and 6
12-item list-- The items of all Pairs

Group VI: Match unsystematic figure patterns

(An exemplar item from each problem is listed below)

Problem 1-- Pineapple: Pineapple; strawberry; cucumber
Problem 2-- Igloo, windmill: Igloo, windmill; diamond, shoes

Problem 3-- Igloo, windmill: Igloo, windmill, soldier girl; cross, square
Problem 4-- Grapes, banana, pear: Grapes, banana, pear; pumpkin, cucumber, corn
Problem 5-- Grapes, banana, pear: Grapes, banana, pear; elephant, lion, monkey; chair, bookcase, bed

Group VII: Sight learn contrasting concrete nouns

(The content of pairs and lists are given below)

Pair 1-- DOG, LOG
Pair 2-- DOOR, DOG
Pair 3-- DOLL, LOG
Sublist 1-- The four words of Pairs 1-3
Pair 4-- FLAG, FROG
Pair 5-- FLAG, GIRL
Sublist 2-- The three words of Pairs 4-5
Pair 6-- BELL, BELT
Pair 7-- BELL, BALL
Sublist 3-- The three words of Pairs 6-7
10-word list-- The words of all pairs

Group VIII: Match and sight learn concrete nouns

(Sight learn Group VII materials; an exemplar item from each matching problem is listed below).

Problem 1-- DOLL: BOLL, DOOR, DOLL
Problem 2-- GIRL: CURL, GIRL, FROG

Task 2-- Sight learn contrasting words

(The content of pairs and lists for each word set is listed below).

	Set 1	Set 2
Pair 1	--LET, PET	HIM, JIM
Pair 2	--FOR, FOX	CAN, CAT
Sublist 1-- The words in Pairs 1 and 2		
Pair 3	--ME, MAD	TO, TOLD
Pair 4	--HAD, HID	SHE, SEE
Pair 5	--IT, TIM	WAS, SAW
Sublist 2-- The words in Pairs 3, 4, and 5		
10-word list-- The words in all Pairs		

Task 3-- List and sentence learn function and content words

(The words, sentences and their order of parctice and testing is listed below for each word set).

Sequence A--	Set 1	Set 2
Words:	SHE, THE, HERE, IS	THE, US, WE, THEM
Sentences:	PLAY FOR ME	SHE WAS BAD
	LET IT FALL	RUN TO HIM
	SAM HAD FUN	TOM CAN GO
Test:	PLAY, FALL, FUN, SAM	BAD, GO, TOM, RUN

Sequence B-- Sequence A words and sentences learned in reverse order.

Sequence C--		
Words:	PLAY, FALL, RUN SAM	BAD, GO, TOM, RUN
Sentences:	PET THE FOX	SEE THE CAT
	TIM IS MAD	JIM SAW US
	SHE HID HERE	WE TOLD THEM
Test:	SHE, THE, HERE, IS	THE, US, WE, THEM

Sequence D-- Sequence C words and sentences learned in reverse order.

Task 4-- Recall and sentence practice Tasks 2 and 3 words

(The 18 words in the recall test are listed above under Task 2 and 3 materials; the 5 sentence of each word set are listed below).

Set 1	Set 2
TIM HID THE PET	THE CAT WAS BAD
SHE LET TIM FALL	TOM TOLD US TO GO
SAM HAD THE FOX	SHE TOLD HIM TO RUN
PLAY IS FUN HERE	JIM SAW US GO
PLAY IT FOR SAM	WE CAN SEE THEM RUN

APPENDIX II
SUMMARY TABLES OF ANOVA RESULTS

TASK 2 WORD PAIRS: AVERAGE TRIALS TO CRITERION

Source	df	MS	F
Between Subjects	63		
1 Task 1 Treatment	7	39.00	.94
2 Word Set	1	5.77	.14
1 x 2	7	65.36	1.57
S/1x2	48	41.60	
Within Subjects	256		
3 Word Pairs	4	352.37	15.32*
1 x 3	28	28.22	1.23
2 x 3	4	198.97	8.65*
1 x 2 x 3	28	19.62	.85
3 x S/1x2	192	23.00	
TOTAL	319		

*$p < .01$ (4/192) = 3.42

TASK 2 SUBLISTS: AVERAGE TRIALS TO CRITERION

Source	df	MS	F
Between subjects	63		
1 Task 1 Treatment	7	142.02	2.07
2 Word Set	1	484.38	7.06*
1 x 2	7	55.99	.82
S/1x2	48	68.60	
Within Subjects	79		
3 Sublists	1	3,949.38	118.71**
1 x 3	7	41.84	1.26
2 x 3	1	468.94	14.10**
1 x 2 x 3	7	39.05	1.17
3 x S/1x2	63	33.27	
TOTAL	142		

*p<.05 (1/48) = 4.04
**p<.01 (1/63) = 7.06

TASK 2 10-WORD LIST ERRORS

Source	df	MS	F
1 Task 1 Treatment	7	185.93	1.02
2 Word Set	1	97.51	.53
1 x 2	7	194.09	1.06
Within Subjects	48	182.73	
TOTAL	63		

TASK 3 FINAL WORD TEST ERRORS

Source	df	MS	F
1 Word Set	1	6.89	.56
2 Practice Order	1	13.14	1.07
3 Word Type	1	34.52	2.80
1 x 2	1	8.26	.67
1 x 3	1	34.52	2.80
2 x 3	1	62.02	5.03*
1 x 2 x 3	1	.02	.001
Within Subjects	56	12.32	
TOTAL	63		

*$p < .05$ (1/56) = 4.02

TASK 4 PRETEST RECALL ERRORS

Source	df	MS	F
Between Subjects	63		
1 Task 1 Treatment	7	27.32	1.63
2 Word Set	1	.94	.06
3 Task 3 Sentence Word Type	1	46.32	2.76
1 x 2	7	5.64	.34
1 x 3	7	16.12	.96
2 x 3	1	2.82	.17
1 x 2 x 3	7	20.01	1.19
S/1x2x3	32	16.76	
Within Subjects	64		
4 Word Type	1	106.94	23.40**
1 x 4	7	2.64	.58
2 x 4	1	29.07	6.36*
3 x 4	1	53.82	11.78**
1 x 2 x 4	7	1.59	.35
1 x 3 x 4	7	7.30	1.60
2 x 3 x 4	1	.94	.21
1 x 2 x 3 x 4	7	1.82	.40
4 x S/1x2x3	32	4.57	
TOTAL	127		

*p<.05 (1,32) = 4.16
**p<.01 (1,32) = 7.51

TASK 4 POSTTEST RECALL ERRORS

Source	df	MS	F
Between Subjects	63		
1 Task 1 Treatment	7	49.06	2.18
2 Word Set	1	.07	.003
3 Task 3 Sentence Word Type	1	31.00	1.37
1 x 2	7	11.57	.51
1 x 3	7	36.47	1.62
2 x 3	1	1.76	.08
1 x 2 x 3	7	10.97	.49
S/1x2x3	32	22.57	
Within Subjects	64		
4 Word Type	1	217.88	33.16**
1 x 4	7	1.49	.23
2 x 4	1	41.63	6.34*
3 x 4	1	37.20	5.66*
1 x 2 x 4	7	1.27	.19
1 x 3 x 4	7	2.66	.40
2 x 3 x 4	1	1.75	.27
1 x 2 x 3 x 4	7	4.40	.67
4 x S/1x2x3	32	6.57	
TOTAL	127		

*p<.05 (1,32) = 4.16
**p<.01 (1,32) = 7.51

TASK 4 FIRST SENTENCE TRIAL ERRORS

Source	df	MS	F
Between Subjects	63		
1 Task 1 Treatment	7	23.86	3.23**
2 Word Set	1	.38	.05
3 Task 3 Sentence Word Type	1	25.38	3.44
1 x 2	7	5.20	.71
1 x 3	7	9.81	1.33
2 x 3	1	5.70	.77
1 x 2 x 3	7	8.20	1.11
S/1x2x3	32	7.38	
Within Subjects	64		
4 Word Type	1	7.51	3.93
1 x 4	7	1.97	1.03
2 x 4	1	1.76	.92
3 x 4	1	10.70	5.60*
1 x 2 x 4	7	2.08	1.09
1 x 3 x 4	7	.55	.29
2 x 3 x 4	1	1.76	.92
1 x 2 x 3 x 4	7	1.18	.62
4 x S/1x2x3	32	1.91	
TOTAL	127		

*p<.05 (1,32) = 4.16
**p<.05 (7,32) = 2.32

TASK 4 SENTENCE LIST: TRIALS TO CRITERION

Source	df	MS	F
1 Task 1 Treatment	7	38.59	1.06
2 Word Set	1	210.25	8.74*
3 Task 3 Sentence Word Type	1	16.00	.66
1 x 2	7	16.14	.67
1 x 3	7	16.82	.70
2 x 3	1	1.56	.06
1 x 2 x 3	7	28.38	1.18
S/1x2x3	32	24.06	

*p<.01 (1/32) = 7.51

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